Measuring the Boiling Point of Water at Different Altitudes

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# Title

Measuring the Boiling Point of Water at Different Altitudes

# Aim

To determine how altitude affects the boiling point of water and to compare the measured values with theoretical expectations.

# Theory

## 2.1 Introduction to Clausius–Clapeyron equation

The **Clausius–Clapeyron equation** describes how the pressure and temperature of a substance are related during a phase change — for example, when a liquid boils or a solid melts.

It shows that as temperature increases, the vapour pressure of a liquid also increases. This is because heating gives the molecules more energy to escape from the liquid surface.

In this experiment, the equation helps explain **why the boiling point of water decreases at higher altitudes**:

* Air pressure is lower at high altitudes.
* According to the equation, lower pressure means boiling happens at a lower temperature.

## 2.2 Relationship between boiling point and pressure

The relationship between boiling point and pressure can be estimated using the Clausius–Clapeyron equation:

where is the enthalpy of vaporization, R is the gas constant, and T represents absolute temperature.

# Apparatus

Appropriate picture here (as close as you can) of setup.

* Thermometer
* 250 mL Beaker
* Hot plate
* Distilled water
* Barometer
* Stopwatch

# Method

|  |  |  |  |
| --- | --- | --- | --- |
| Altitude (m) | Pressure (kPa) | Boiling Point (°C) | Deviation (°C) |
| 0 | 101.3 | 100.0 | 0.0 |
| 500 | 95.5 | 98.6 | -1.4 |
| 1000 | 89.9 | 97.2 | -2.8 |
| 1500 | 84.2 | 96.0 | -4.0 |

# Calculations

Percentage deviation from standard boiling point (100 °C):

Percentage deviation =

At 1500 m, deviation =

# Discussion/Conclusion

The data clearly shows a decrease in boiling point with increasing altitude, consistent with the theoretical relationship between pressure and temperature.

Minor experimental deviations could result from thermometer calibration or inconsistent pressure readings.

This experiment demonstrates the importance of considering environmental conditions in temperature-sensitive scientific measurements.